6 Discussion of Results and Conclusions

From the UNET simulations of the physical model and the Illinois Waterway backwaters, UNET can predict the magnitude and shape of the initial wave where there is a backwater channel with one opening into the navigation channel. The UNET model can not provide complete time history of water level change, particularly in the highly reflective environment used in the physical model. For environmental studies of field backwaters that are typically not highly reflective, the magnitude and shape of the initial wave is the primary issue. Water level predictions were generally better than velocity predictions, particularly in the Illinois Waterway backwater. The physical model represents a worst case condition because of the straight alignment, smooth boundaries and vertical walls. As observed in both the physical model and in the UNET model, drawdown in the backwater channel is greater at the upstream end of the backwater than at the mouth. The ratio of the drawdown at the rear over drawdown at the mouth is about 1.5-2. Actual backwaters will tend to respond differently because of the uneven alignment, rough boundaries, and because depths generally decrease gradually at the upstream end of the backwater which leads to a decay of drawdown with distance from the mouth. The Illinois Waterway had drawdown at 800 m from the mouth that was about 1/3 of the drawdown at the mouth.

Sensitivity experiments showed that the model performed well when using a Courant number of about 1. Smearing (decreased amplitude and increased wavelength) occurred for larger Courant numbers whereas numerical oscillation was present at lesser Courant numbers, particularly in the Illinois Waterway backwater channel. Sensitivity runs for the Illinois Waterway backwater showed that the maximum reach length that could be used between cross sections was about 32 m. Sensitivity experiments are required on all UNET simulations to determine the maximum reach length between cross sections. This can be accomplished easily in UNET using the XK card in the cross section input file which sets the maximum distance for interpolated cross sections.

For both the smooth laboratory backwater and the prototype backwater, n values consistent with those used for typical steady water surface profile computations were used in the UNET simulations and provided a reasonable fit of the unsteady drawdown event.

While the results with UNET are promising, it should be remembered that the UNET model has been compared to only one laboratory and one field backwater channel. Because backwaters vary in shape, alignment, roughness, length, connection to backwater lakes, etc, and drawdown events can vary in shape and magnitude, additional comparisons are needed to establish proper n values, time steps, and distance between cross-sections. To the author's knowledge, data for other backwaters did not exist at the time of this study.